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None

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## (54) Tamper-evident package

(57) A tamper-evident closure 1 includes several radially inwardly extending lugs 9 on a tamper-evident band 4 joined to the closure skirt 3 by way of frangible bridges 5, and intended to be broken by a bead 8 of the container neck upon unscrewing of the closure. On initial application of the closure to the container, the lugs 9 pass over regions 8a of the bead 8 having lesser radially outward projection but upon partial removal of the closure from the container the lugs 9 become trapped under bead regions 8b of greater radially outward projection (by virtue of a wavy deformation of the tamper-evident band 4 upon unscrewing). The closure may comprise a flowed-in or moulded gasket.

Fig.1.

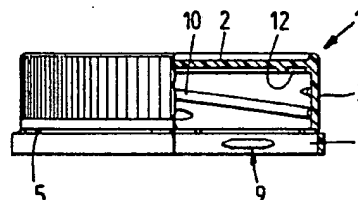
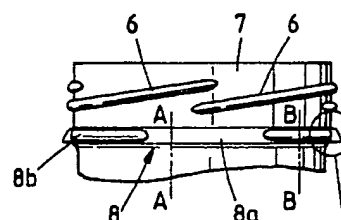


Fig.2.



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## SPECIFICATION

### Tamper-evident package

5 The present invention relates to a tamper-evident closure for a container, and to a package comprising such a closure mounted on a container.

10 Tamper-evident closure constructions are known in which the closure is applied to the container while still retaining an integral portion which engages the container and is damaged in some way when the closure is unscrewed from the threaded neck of the container. The present invention aims to provide an improvement in such a type of tamper-evident closure.

15 In accordance with the present invention we provide a package comprising a container having an externally threaded neck and a tamper-evident formation below the threads thereof; and a tamper-evident closure including a threaded skirt, an end panel closing one end of the skirt, and a tamper-evident annular portion attached to the other end of the skirt but adapted to be damaged by deformation upon at least partial removal of the closure from the container, the tamper-evident annular portion including radially inwardly extending lugs spaced around the tamper-evident annular portion, and adapted to pass said tamper-evident formation as the closure is applied to the container neck; wherein said tamper-evident formation of the container neck comprises a radially outwardly extending bead; and wherein said bead includes several equiangularly spaced regions of greater radially outward projection and an equal number of equiangularly spaced regions of lesser outward projection interspersed therewith, the configuration of said regions of lesser radially outward projection being related to the container threads such that during screwing of the closure onto the container neck each said radially inward projecting lug passes over a said region of lesser radially outward projection to become trapped thereunder whereupon unscrewing of the closure causes each said radially inward projecting lug to pass along the bead by resilient deformation of said tamper-evident annular portion until said lug is below a said bead region of greater radially outward projection, thereby ensuring damage to said tamper-evident annular portion of the closure.

55 In the preferred embodiment, the extent of radially outward projection of the bead at the regions of lesser radially outward projection is enough to guarantee to hold the lug of the tamper-evident annular portion of the closure down as the closure starts its unscrewing rotation. However, it may not be enough to hold the lugs down as the tamper-indicating damage occurs, so the extent of projection at each region of greater radially outward projection is great enough to do so, even bearing in

mind the distortion to which the annular portion is subjected. Thus while the regions of lesser radially outward projection allow screwing on, and the initial unscrewing, it is the regions of greater radially outward projection (which might not allow the lug to pass during screwing on) which hold the lugs down during damage, thereby indicating that the pack has been tampered with.

70 The damage to the tamper-evident band may be either by rupture of bridges holding the band to the rest of the closure or by rupture of bridges of the band itself allowing the band to disintegrate while its component parts are still carried by the closure, but the disintegration both indicates tampering and results in removal of the band from the container. This latter construction is useful where a recyclable container is required.

85 The tamper-evident package in accordance to the present invention is particularly suitable for glass containers or containers moulded of other relatively hard material where precision of moulding over a long term may be difficult to achieve and where the mere provision of a bead on the container to retain the tamper-evident band of the closure presents no real problem whereas a more intricate tamper-evident component on the container would give problems.

95 In order that the present invention may more readily be understood the following description is given, merely by way of example, with reference to the accompanying drawings in which:

100 FIGURE 1 is a side elevational view, partly sectional, of a tamper-evident closure of a package in accordance with the present invention;

105 FIGURE 2 is a side elevational view of the neck of a container to receive the closure of Figure 1;

110 FIGURE 3 is a detail, as a cross-section, of the tamper-evident bead of the container neck of Figure 2;

FIGURE 4 is a top plan view of the container neck of Figure 2;

FIGURE 5 is a side elevational view showing the closure in section at the start of screwing on of the closure on the container neck;

115 FIGURE 6 is a view similar to Figure 5 but showing a more advanced stage of the screwing down operation;

120 FIGURE 7 is a view similar to Figure 5 and 6 showing the closure screwed fully home and the container thus sealed;

125 FIGURE 8 is a side elevational view similar to Figure 1 but illustrating the tamper-evident closure at the start of an unscrewing operation during straining of the tamper-evident feature,

130 FIGURE 9 shows an alternative embodiment in which the annular tamper-evident portion of the closure breaks into separate segments to indicate tampering, and is in the form of a

section on the line IX-IX of Figure 10;

FIGURE 10 is a side elevational view showing the closure device of Figure 9 on a jar but before any attempt to remove the closure device; and

FIGURE 11 is a side elevational view showing the closure device of Figures 9 and 10 after removal from the jar, and illustrates the modified form of tamper-indicating damage sustained by the tamper-evidence band.

As shown in Figure 1, the package in accordance with the present invention comprises a closure 1 having a top panel 2 and an internally threaded skirt 3, the free end of the skirt being joined to a tamper-evident band 4 by means of frangible bridges 5 which are also shown in Figure 8.

The container is shown in Figure 2 as comprising a four start thread 6 on an upper neck portion 7, and comprising also a bead 8 at the bottom of the upper neck portion 7, clear of the threads.

Figure 3 shows two separate cross-sectional profiles of the bead 8. The first profile 8A constitutes the cross-section at plane A-A of Figure 2 and shows a portion of the bead where its radially outward projection is less than at other points and where its profile is of a generally trapezoidal form with the incline surface forming a ramp diverging from the cylindrical portion 7 in the downward direction. The second profile 8B corresponds to the profile of the bead 8 at the plane B-B and illustrates a much greater radially outward extent of cross-section of the bead. As can be seen from Figures 2 and 4, there are several of the greater radial projection regions having the profile 8B and several of the lesser radial projection profile regions having the cross-section 8A, with these two profile regions being interspersed equiangularly around the container neck. In the preferred embodiment there are four regions 8a having the profile 8A interspersed between four regions 8b having the profile 8B.

As shown in Figure 1, the tamper-evident band 4 of the closure 1 includes four radially inwardly projecting lugs 9 of which one is visible on the right hand side in Figure 1.

These lugs are equiangularly spaced around the tamper-evident band 4.

Equally interspersed with the equiangularly spaced lugs 9 on the tamper-evident band are the regions where the bridges 5 are located. preferably there is either a single bridge equidistant between two successive lugs 9 or a localized group of such bridges, there being an equal number of such individual bridges or groups of bridges equivalent to the number of lugs 9, and in turn this is an integral multiple of the number of thread starts, and is preferably equal to the number of thread starts. In the present case there are four thread starts 6, four lugs 9, and four groups of frangible bridges 5.

The tamper-evident band 4 of the closure 1 is constructed with sufficient flexibility to allow radially outward deformation of the zones of the band 4 at which the inwardly projecting lugs 9 are formed, and the placing of the lugs 9 in relation to the threads 10 of the closure is such that, as the co-operating threads 6 and 10 of the container and closure constrain the closure to rotate and descend due to the helical formation of the threads, the lugs 9 are caused to contact the regions 8a at which the radially outward extent of the bead 8 is reduced, and as they pass downwardly over and peripherally along those regions 8a the lugs are able to ride outwardly to pass over the lower most edge 11 of the regions 8a, shown in Figure 3.

However, during unscrewing of the closure 1 the lugs 9 will initially be held underneath the lower edge 11 of the ramp-like bead region 8a and then on further unscrewing of the closure 1 the tamper-evident band 4 is able to distort sufficiently to allow each lug 9 to pass under the next adjacent maximum extent outwardly projecting bead region 8b so as to provide a much more positive downward holding action on the lug 9.

Figure 5 shows the lug 9 about to enter an associated region 8a of the bead 8 during screwing down, and Figure 6 shows that lug 9 disposed centrally of the region 8a during a later stage of the screwing down operation. In Figure 7 there can be seen the lug 9 at the extreme far end (left hand end) of the low projection region 8a which it has just crossed. In this configuration the closure 1 is screwed fully home on the container neck.

Figure 8 illustrates the above mentioned configuration in which the flexibility of the tamper-evident band 4 has allowed the lugs 9 to move downwardly relative to the skirt 3 of the closure 1 sufficiently to allow the lug 9 to position itself under the right hand end of the lesser radial projection bead region 8a, and to begin to position itself under the left hand end of the high projection bead region 8b, as shown in the broken line position 9' of Figure 7.

By virtue of the positioning of the bridges either individually or in groups, arranged symmetrically between two adjacent equiangularly spaced lugs 9, maximum deformation of the band 4 is provided until ultimately the bridges 5 are all caused to snap positively, thereby releasing the tamper-evident band 4 to remain trapped under the bead 8 while the rest of the closure is removed.

The transverse sectional view of Figure 9 shows that the alternative embodiment 21 of the closure device has a four-start thread 23 but an entirely different type of tamper-evidence band formed of four segments 24a, 24b, 24c and 24d.

In this case, the rupturable bridges form junctions between adjacent ends of the pairs

of tamper-evidence band sectors 24a, 24b, 24c and 24d and there are additional bridges 30 which are not intended to rupture but which join the individual tamper-evidence band segments to the skirt of the closure.

In this particular form of the second embodiment the lugs are formed on the ends of each tamper-evidence band segment and in Figures 9 to 11 they bear the same subscript letter as the segment itself. Hence there are two lugs 29a positioned at the ends of the tamper-evidence band segment 24a, and so on.

When this embodiment of closure device 21 is unscrewed from the jar, the various pairs of lugs 29a, 29b, 29c and 29d are initially engaged under the bead regions 8a of lesser radially outward projection, but then pass along to be held more positively under the regions 8b of greater radial projection whereupon further unscrewing results in a downward thrust of the pairs of lugs 29a, 29b, 29c and 29d relative to the closure, and in particular relative to the bridges 30 which join the tamper-evidence band segment 24a, 24b, 24c and 24d to the skirt, so as to create the deformation shown in Figure 11 as having resulted in physical separation of the four tamper-evidence band segments from one another.

The important difference between the embodiment of Figures 9 to 11 and that of the earlier Figures is that in this second embodiment the tamper-evidence band remains attached to the closure skirt, but has nevertheless sustained tamper-indicating damage in the form of rupture at the frangible bridges 25 so that it will be clear to a potential purchaser that the closure has at least once been removed from the jar or other container.

Any suitable plastic material may be used for moulding the closure, such as polypropylene, ethylenepropylene copolymer, polyethylene, polystyrene, polyethylene terephthalate, and may be with or without fillers, and may include any suitable pigments, dyes, anti-static agents, anti-oxidants, and lubricants.

The closure in accordance with the present invention may be a plastic closure provided with a gasket of a material softer than that of the rest of the closure, to facilitate sealing. Alternatively the closure may be ungasketed.

The illustrations of the closure and of the gasket in the drawing are not limiting, and any other suitable shape of either the closure or the gasket may be provided. For example, the end panel of the closure may be generally flat but include upstanding projections serving as the mechanical adhesion-enhancing means to interengage with the moulded gasket.

The closure may, if desired, include an internal retaining bead on the skirt, near the corner between the skirt and the end panel, to retain a soft liner in place. This bead may be either continuous or interrupted.

The profile of a gasket in the closure may, furthermore, be such that it seals on the inside corner of the bottle neck, as described and claimed in European Patent Application No. 85304379.2.

The gasket may be flowed-in or moulded.

The closure may have any one of a range of diameters currently contemplated, or likely to be contemplated in the future, for bottle or jar sealing use.

The threads may, if desired, include vent slots providing discontinuities in the helical threads and able to allow the escape of air both during any gasket-moulding operation and during screwing of the closure 1 onto a bottle.

As is already known in the art, where the closure is gasketed it may include printing either externally for identification of the contents, or internally for "promotional features". Where such an internal printing for promotional purposes is provided the heating of the cap before application of a gasket composition will be carefully controlled to impart peelability to the gasket i.e. to enable the consumer to remove the gasket readily from the closure to read the printing. The printing may, if desired, become apparent on the gasket.

Also, if gasketed, the closure may optionally be provided on the interior of the end panel with a rib which serves to brace the relatively softer plastic composition of the gasket and is therefore embedded in the gasket but acts to press it against the end of the bottle neck, thereby increasing the stress within the gasket and enhancing the pressure-sealing action.

If desired the skirt of the closure may be provided, near its rim, with internal axially extending ribs to rigidify the skirt.

In the preferred form of the closure, illustrated the drawings, the closure is particularly suitable for use with container neck finish GF207 modified only by providing a trapezoidal cross-section to regions of the transfer ring, but generally the closure in accordance to the present invention is suitable for use with any container neck finish which is traditionally moulded from glass or another hard material and which may therefore be subject to some dimensional variation, it being necessary only that the glass finish is provided with a bead of relatively simple design to cooperate with the radially inwardly extending lugs to allow the lugs to pass over the bead during application of the closure but to resist return movement during removal of the closure.

If desired, the lugs 9 or 29a, 29b, 29c, 29d may be orientated on a helix, in which case the axial extent of the tamper-evident band will need to be increased in order to accommodate the inclined lug.

The number of thread starts of the threads on the closure and on the container will be equal to the number of zones 8a of reduced

radially outward projection.

It is, for example, possible for the container neck and the closure each to have a single start thread, for example a continuous single

5 start thread.

Although in the drawings the tamper-evident band 4 is stepped radially outwardly relative to the rest of the cylindrical skirt of the closure 1 (see, for example, Figure 1), it is possible for the tamper-evident band to be substantially flush with the skirt 3, although in that alternative embodiment it would be important to position the lugs 9 correctly so that they pass between the successive starts of the thread 6 on the container neck cylindrical portion 7. Because, in the drawing, the outward stepping of the tamper-evident band allows the lugs 9 to be disposed radially outwardly relative to the cylinder on which the thread tips of the external threads 6 of the container lie in the closed position of the container and closure combination, it is possible to ensure that the lugs 9 will always pass over the threads 6 and thus positioning of the lugs relative to the threads 10 of the closure is not so critical.

In the above mentioned variation in which the tamper-evident band is substantially flush with the skirt 3 of the closure, the arrangement of the lugs 9 as parts of a helix is particularly convenient.

It will of course be appreciated that other configurations of lug 9 or 29a, 29b, 29c, 29d may be provided, for example a cylindrical or hemispherical pip.

#### CLAIMS

1. A package comprising a container having an externally threaded neck and a tamper-evident formation below the threads thereof; and a tamper-evident closure including a threaded skirt, an end panel closing one end of the skirt, and a tamper-evident annular portion attached to the other end of the skirt but adapted to be damaged by deformation upon at least partial removal of the closure from the container, the tamper-evident annular portion including radially inwardly extending lugs spaced around the tamper-evident annular portion, and adapted to pass said tamper-evident formation as the closure is applied to the container neck; wherein said tamper-evident formation of the container neck comprises a radially outwardly extending bead; and wherein said bead includes several equiangularly spaced regions of greater radially outward projection and an equal number of equiangularly spaced regions of lesser outward projection interspersed therewith, the configuration of said regions of lesser radially outward projection being related to the container threads such that during screwing of the closure onto the container neck each said radially inward projecting lug passes over a said region of lesser radially outward projection to become

trapped thereunder whereupon unscrewing of the closure causes each said radially inwardly projecting lug to pass along the bead by resilient deformation of said tamper-evident annular portion until said lug is below a said bead region of greater radially outward projection, thereby ensuring damage to said tamper-evident annular portion of the closure.

2. A package according to claim 1, wherein the cross-section of each said region of lesser radially outward projection of the container bead is convergent in a direction towards the rim of the container neck, thereby cammingly engaging a said lug to deform the tamper-evident annular portion radially outwardly as the closure descends during screwing on; and wherein the edge of said bead further from the rim of the container neck is shaped to resist return movement of said lugs during unscrewing of the closure.

3. A package according to claim 1 or 2, wherein said tamper-evident annular portion is attached to the closure skirt by means of bridges which rupture to separate the tamper-evident annular portion from the closure skirt as tamper-evident damage to said annular portion during deformation of said tamper-evident annular portion upon unscrewing of the closure.

4. A package according to claim 3, wherein said lugs and bridges of the closure are either individually substantially equiangularly spaced so that one bridge is equidistant from two adjacent said lugs or groups of said lugs, or arranged with groups of said bridges substantially equiangularly spaced and equidistant between adjacent said lugs or said groups of lugs.

5. A package according to claim 4, wherein the threaded skirt has an internal multi-start thread, and the number of said lugs or groups of lugs is an integral multiple of the number of starts of said multi-start thread.

6. A package according to claim 5, wherein the number of lugs or groups of lugs is equal to the number of thread starts.

7. A package according to claim 4 or 5, wherein the tamper-evident annular portion includes a series of individually equiangularly spaced said lugs and a series of individually equiangularly spaced said bridges.

8. A package according to claim 7, wherein the multi-start thread has four thread starts and there are four of said bridges and four of said lugs.

9. A package according to claim 1 or 2, wherein the tamper-evident annular portion comprises a plurality of segments joined to the closure skirt by flexible connections and joined to one another by rupturable connections which rupture to indicate tampering.

10. A package according to any one of claims 1 to 3 and 9, wherein said threads of the closure and the container are single start threads.

11. A package substantially as hereinbefore described with reference to, and as illustrated in Figures 1 to 8, or Figures 9 to 11, of the accompanying drawings.

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Fig.1.

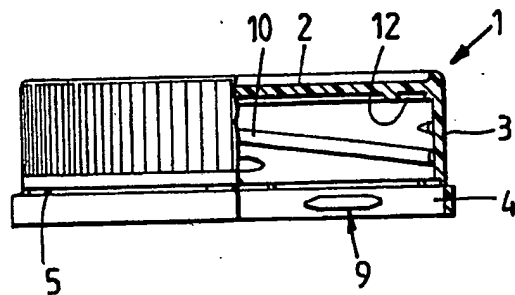


Fig.2.

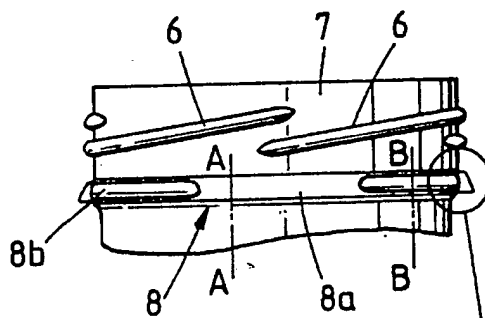


Fig.3.

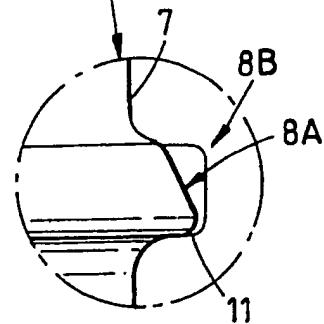


Fig.4.

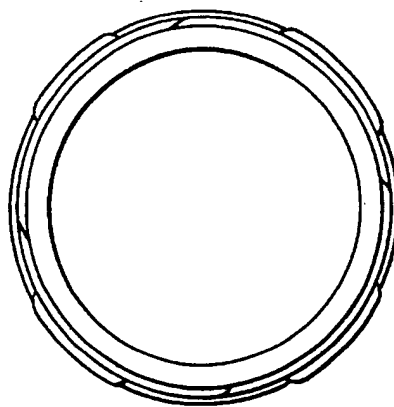


Fig. 5.

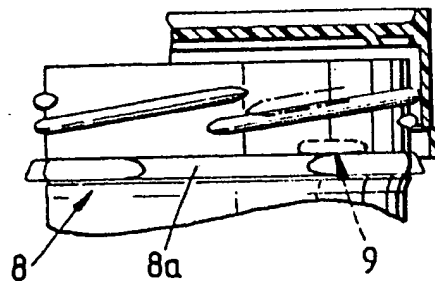


Fig. 6.

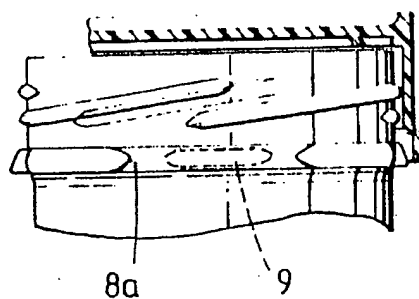


Fig. 7.

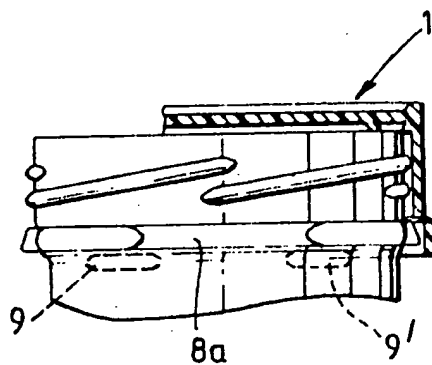


Fig. 8.

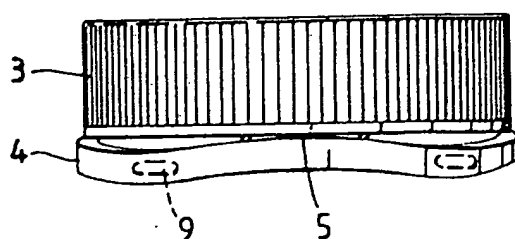




Fig. 9.

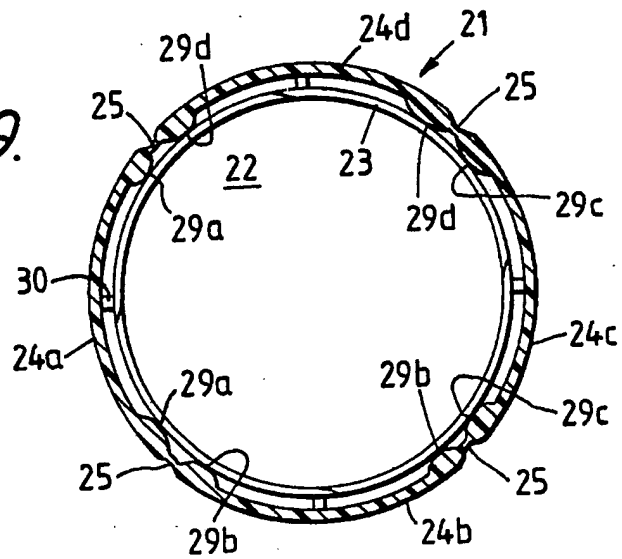


Fig. 10.

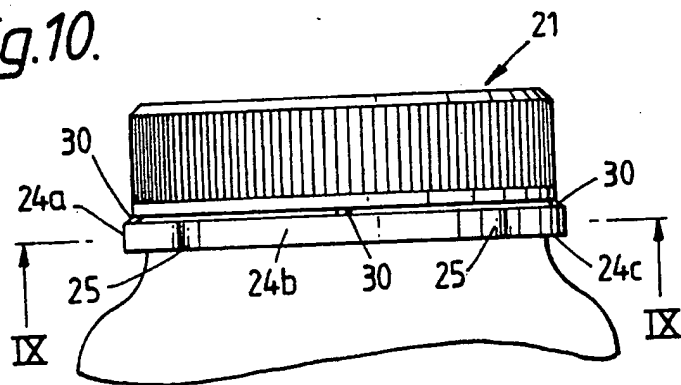


Fig. 11.

